

OPERATION OF A COMPUTER WITH TOUCH SCREEN INTERFACE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation-in-part of prior application Ser. No. 10/903,964, from which priority under 35 U.S.C. §120 is claimed, which is hereby incorporated by reference in its entirety. This application is also related to the following co-pending applications: U.S. Ser. No. 10/840,862, filed May 6, 2004; U.S. Ser. No. 11/048,264, filed Jul. 30, 2004; U.S. Ser. No. 11/038,590, filed Jul. 30, 2004; Atty. Docket No.: APL1P307X2 (U.S. Ser. No. _____), entitled “ACTIVATING VIRTUAL KEYS OF A TOUCH-SCREEN VIRTUAL KEYBOARD”, filed concurrently herewith; and Atty. Docket No.: APL1P307X3 (U.S. Ser. No. _____), entitled “VIRTUAL INPUT DEVICE PLACEMENT ON A TOUCH SCREEN USER INTERFACE”, filed concurrently herewith; all of which are hereby incorporated herein by reference in their entirety for all purposes.

BACKGROUND

[0002] 1. Technical Field

[0003] The present patent application relates to touch screen user interfaces and, in particular, relates to operation of a computer based on interaction by a user with a virtual GUI item, such as a virtual keyboard on a touch screen user interface.

[0004] 2. Description of the Related Art

[0005] A touch screen is a type of display screen that has a touch-sensitive transparent panel covering the screen, or can otherwise recognize touch input on the screen. Typically, the touch screen display is housed within the same housing as computer circuitry including processing circuitry operating under program control. When using a touch screen to provide input to an application executing on a computer, a user makes a selection on the display screen by pointing directly to graphical user interface (GUI) objects displayed on the screen (usually with a stylus or a finger).

[0006] A collection of GUI objects displayed on a touch screen may be considered a virtual keyboard. Similar to a conventional external keyboard that is not so closely associated with a display screen, the virtual keyboard includes a plurality of keys (“virtual keys”). Activation of a particular virtual key (or combination of virtual keys) generates a signal (or signals) that is provided as input to an application executing on the computer.

[0007] Touch screen keyboards, by nature of the hardware on which they operate, typically glean much more information about a user’s actions than can be gleaned with a typical external keyboards. For example, whereas a typical external keyboard includes a single “sensor” (such as a mechanical switch or electrical connection) or a small number of sensors per key, touch screen keyboards typically have many more sensors per virtual key.

[0008] It is desirable to use the information about a user’s actions to make the user experience with the computer, via the touch screen virtual keyboard, more powerful than is usual (or, perhaps, even possible) with computers using external keyboards.

[0009] On the other hand, even touch screens, with their numerous sensors, typically lack the ability to directly glean some types of information about a user’s actions. It is desirable to use the information available to infer other types of information, for example, information which cannot be directly gleaned about the user’s actions.

SUMMARY

[0010] A touch screen computer executes an application. A method of operating the touch screen computer in response to a user is provided. A virtual input device is provided on the touch screen. The virtual input device comprises a plurality of virtual GUI items (which may be, in some specific examples, virtual keys of a virtual keyboard). It is detected that a user has touched the touch screen to nominally activate at least one virtual GUI item (e.g., virtual key), and a behavior of the user with respect to touch is determined. The determined behavior is processed and a predetermined characteristic is associated with the nominally-activated at least one virtual GUI item. A reaction to the nominal activation is determined based at least in part on a result of processing the determined behavior.

BRIEF DESCRIPTION OF FIGURES

[0011] FIG. 1 is a block diagram of an exemplary touch-screen based computer system, in accordance with one embodiment of the present invention

[0012] FIG. 2 is a flow chart broadly illustrating a method by which behavior of a user’s touch, with respect to a virtual input device displayed on a touch screen of a multipoint sensing device, is processed to affect a reaction to the user’s touch.

[0013] FIG. 3 illustrates using processing signals created by the multipoint sensing device in response to the user’s touch in order to infer the pressure with which the user’s touched the touch screen to activate a nominally-activated virtual key.

[0014] FIG. 4 illustrates a table data structure useable to determine reactions based on matching predetermined behavioral characteristics to actual behavioral characteristics with respect to nominally-activating particular virtual keys.

[0015] FIG. 5 is a flowchart illustrating an example of processing to determine a reaction with respect to particular user behavior.

[0016] FIG. 6A illustrates a timeline corresponding to “durations” of user behavior in the temporal domain.

[0017] FIG. 6B illustrates a table data structure similar to the table illustrated in FIG. 4, to determine reactions based on user behaviors with respect to “durations” such as are illustrated in FIG. 6A.

[0018] FIG. 7 illustrates a table structure for determining reactions based on user behavior with respect to nominally activating combinations of virtual keys.

[0019] FIG. 8 is a flow chart illustrating an example of processing to determine a reaction with respect to particular user behavior with respect to nominally activating combinations of virtual keys.